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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants:	Inou Toru et al.
Serial No.:	10/551,124
Filed:	September 26, 2005
For:	ULTRA-LIGHT SOUND INSULATOR
Group:	1771
Examiner:	Chang, V.
Conf. No.:	4032

AMENDMENT

Commissioner For Patents
P.O. Box 1450
Alexandria, VA 22313-1450 April 7, 2009

Sir:

This is in response to the Office Action mailed January 7, 2009, in connection with the above-identified application. The amendments are listed below and set forth on the following pages.

Amendments to the Claims; and

Remarks are included following the amendments.

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Currently Amended) An ultra-light sound insulator, comprising:

a sound absorption layer that is light in weight and has a thickness that varies from one region to another in a range of 1 to 100 mm, and a density in a range of 0.01 to 0.2 g/cm^3; and

an air-impermeable resonance layer in the form of a film having a thickness in a range of 10 to 600μm that is bonded to said sound absorption layer via an adhesive layer and has an area-weight of not greater than 600 g/m^2,

wherein an adhesion strength of said adhesive layer against said sound absorption layer and said air-impermeable resonance layer is set in a range of 1 to 20 N/25 mm under conditions of a peel angle of 180 degrees and a peel width of 25 mm,

an adhesion area of said adhesive layer is 50 to 100% of a whole interface between said sound absorption layer and said air-impermeable resonance layer so that resonance due to a total mass of said air-impermeable resonance layer and said sound absorption layer occurs in addition to membrane resonance of said air-impermeable resonance layer, and

said sound absorption layer is adapted to face to a vehicle body panel, while said air-impermeable resonance layer is adapted to face to a vehicle interior.

2-4. (Canceled).

5. (Original) An ultra-light sound insulator in accordance with claim 1, wherein said sound absorption layer has a mono-layer structure and has a density in a range of 0.02 to 0.20 g/cm^3 and a thickness in a range of 2 to 70 mm.

6. (Previously Presented) An ultra-light sound insulator in accordance with claim 5, wherein said sound absorption layer has an initial compression repulsive force in a range of 2 to 200 N.

7-12. (Canceled)

13. (Previously Presented) An ultra-light sound insulator in accordance with claim 1, wherein said air-impermeable resonance layer has a thickness in a range of 20 to 300 μm.

14. (Previously Presented) An ultra-light sound insulator in accordance with claim 1, wherein said sound absorption layer a density in a range of 0.03 to 0.08 g/cm^3.

15. (Previously Presented) An ultra-light sound insulator in accordance with claim 1, wherein said air-impermeable resonance layer has an area-weight of not greater than 300 g/m^2.

16. (Previously Presented) An ultra-light sound insulator in accordance with claim 1, wherein said adhesion strength of said adhesive layer against said sound absorption layer and said air-impermeable resonance layer is set in a range of 3 to 10 N/25 mm under conditions of a peel angle of 180 degrees and a peel width of 25 mm.

17. (Previously Presented) An ultra-light sound insulator in accordance with claim 1, wherein said adhesion area of said adhesive layer is 80 to 100% of a whole interface between said sound absorption layer and said air-impermeable resonance layer.

18. (Previously Presented) An ultra-light sound insulator in accordance with claim 1, wherein said sound absorption layer a density in a range of 0.03 to 0.08 g/cm^3, said air-impermeable resonance layer has an area-weight of not greater than 300 g/m^2, said adhesion strength of said adhesive layer against said sound absorption layer and said air-impermeable resonance layer is set in a range of 3 to 10 N/25 mm under conditions of a peel angle of 180 degrees and a peel width of 25 mm and said adhesion area of said adhesive layer is 80 to 100% of a whole interface between said sound

absorption layer and said air-impermeable resonance layer.

19. (Canceled).

20. (Previously Presented) An ultra-light sound insulator in accordance with claim 5, wherein said sound absorption layer has an initial compression repulsive force in a range of 20 to 100 N.

21. (Previously Presented) An ultra-light sound insulator in accordance with claim 1, said ultra-light sound insulator further comprising a second sound absorption layer bonded to the other face of said air-impermeable resonance layer, which is adapted to face to said vehicle interior,

said second sound absorption layer having a density in a range of 0.05 to 0.15 g/cm^3 and a thickness in a range of 4 to 10 mm.

22. (Previously Presented) An ultra-light sound insulator in accordance with claim 21, wherein said second sound absorption layer has a mono-layer structure.

23-26. (Canceled).

27. (New) An ultra-light sound insulator in accordance with claim 1, wherein the thickness of said sound absorption layer is not greater than 50 mm.

28. (New) An ultra-light sound insulator in accordance with claim 1, wherein the thickness of said sound absorption layer varies in a range of 5-40 mm.

REMARKS

By this amendment, Applicants have amended the claims to more clearly define their invention. In particular, claim 1 has been amended to recite that the sound absorption layer has a thickness that varies from one region to another. See, e.g., Figure 4 and the paragraph bridging pages 20 and 21, as well as the second and third full paragraphs on page 21 of Applicants' Substitute Specification. Applicants have also added claims 27 and 28 to define further aspects of the present invention. These claims are supported by, e.g., the description in the paragraph bridging pages 20 and 21 of Applicants' substitute specification.

Claims 1, 5, 6, 13-18 and 20-22 stand rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 4,966,799 to Lucca et al. Applicants traverse this rejection and request reconsideration thereof.

The present invention relates to an ultra-light sound insulator. The ultra-light sound insulator of the present invention includes a sound absorption layer that is light in weight and has a thickness that varies from one region to another in a range of 1-100 mm and a density in the range of 0.01 to 0.2 g/cm^3. An air-impermeable resonance layer in the form of a film having a thickness in a range of 10-600 μm is bonded to the sound absorption via an adhesive layer and has an area-weight of not greater than 600 g/m^2. Applicants choose the adhesion strength and adhesion area of the adhesive layer to provide a particular resonance. That is, the adhesion strength of the adhesive layer against the sound absorption layer and the air-impermeable resonance layer is set in a range of 1-20 N/25 mm under conditions of an peel

angle 180° and a peel width of 25 mm while an adhesion area of the adhesive layer is 50-100% of a whole interface between the sound absorption layer and the air-impermeable resonance layer. This provides a sound insulator in which resonance due to a total mass of the air-impermeable resonance layer and the sound absorption layer occurs in addition to the membrane resonance of the air-impermeable resonance layer. In the ultra-light sound insulator of the present invention, the sound absorption layer is adapted to face a vehicle body panel while the air-impermeable resonance layer is adapted to face a vehicle interior. Such an ultra-light sound insulator is not disclosed by or obvious over Lucca et al.

The Lucca et al. patent discloses a structural element that contains a first sound-absorbing and thermally insulating layer 21 and a second-insulating, dimensionally stable supporting layer 23. A porous or microporous decorative layer 22 can be applied to the outside of the first layer and a thermal formed carpet 24 can be applied to the outside of the supporting layer. A heat-sealable adhesive layer 27 can be placed between the two layers, the adhesive layer increasing the bond between the two layers. It is disclosed that, because of the dimensionally stable supporting layer, the structural element can be used as a sound screen without a holding frame or as a sound-insulating body work part without a supporting surface.

The structural element of Lucca et al. is different in both structure and concept from the ultra-light sound insulator of the present invention.

The sound insulator of the present invention is an ultra-light sound insulator. It is intended to be ultra-light and formed so that the sound

absorption layer is adapted to face a vehicle body panel, while the air-permeable resonance layer is adapted to face a vehicle interior.

The ultra-light sound insulator of the present invention does not need to be dimensionally stable, does not need to itself to form a structural element, and can have its thickness varied to adopt to the vehicle body panel to which it is applied. In contrast, because of the dimensionally stable supporting layer In Lucca et al., it is intended to form a structural element that can be used without a holding frame or without a supporting surface.

Because of the differences in concept between the structural element of Lucca et al and the ultra-light sound insulator of the present invention, the structures of the structural element of the Lucca et al. and the ultra-light sound of insulator of the present invention are different.

One difference in structure between the ultra-light sound insulator of the present invention and the noise-reducing structural element of Lucca et al. is that the sound absorption layer in the ultra-light sound insulator of the present invention has a thickness that varies from one region to another in a range of 1 to 100 mm.

On the other hand, Lucca teaches that an element which is to be used as a sound screen and needs to have little mechanical stability but good sound absorption should possess a relatively thin supporting layer and a comparatively thick padding layer. In short, the sound screen of Lucca should have a comparatively thick padding layer. That is, in the sound screen of Lucca, high sound absorption rate cannot be assured when the thickness of the sound absorption layer is varied or reduced.

On the contrary, in the present invention, a high sound absorption rate is assured even when the thickness of the sound absorption layer is varied or reduced in a region according to the conditions, such as the needed shape of a product, due to other features in claim 1, such as the resonance layer and the adhesion conditions (adhesion strength and adhesion area) between the resonance layer and the absorption layer. Moreover, the sound absorption rate is assured in an even wider frequency domain and thus the sound absorption rate is improved as a whole by varying the thickness of the sound absorption layer, compared to a sound insulator that has a sound absorption layer without thickness variation.

Varying the thickness of the sound absorption layer is not disclosed in Lucca. It rather contradicts the requirement of a comparatively thick padding layer. Accordingly, the advantageous effect of the present invention that sound absorption is improved as a whole in a wider frequency domain by varying the thickness of the sound absorption layer is not achieved by the sound screen of Lucca.

As for the resonance layer of the present invention, it is also different from the relatively thin supporting layer of Lucca. The resonance layer of the present invention is light in weight and has a low rigidity. This also contributes to the above advantageous effect. On the contrary, relatively thin supporting layer of Lucca should still have rather high rigidity as long as it is called "supporting layer". And this is suggested all over the claims and the specification of Lucca, for example, in the phrase "said second layer comprising rigid, impermeable, thermoformed, synthetic, and self-supporting

material " in claim 1 of Lucca. In the present invention, resonance arises independently in a narrow area because the resonance layer has a low rigidity, and this leads to an improved sound absorption in a wider frequency domain when thickness of the sound absorption layer is varied with location. On the contrary, rigidity of the supporting layer of Lucca prohibits resonance to arise independently in a narrow area, and thus prohibits the improvement in the sound absorption when the thickness of the padding layer is varied with location. The resonance layer of the present invention is thus different from the relatively thin supporting layer of Lucca that is rigid and that needs a comparatively thick padding layer to assure sound absorption. The resonance layer of the present invention would not have been obvious from the comparatively thin supporting layer of Lucca.

See, also, Applicants' remarks accompanying the Amendment After Final Rejection filed October 20, 2008, which remarks are incorporated herein by reference.

For the foregoing reasons, the presently claimed invention is patentable over Lucca et al.

In view of the foregoing amendments and remarks, favorable reconsideration and allowance of all the claims now in the application are requested.

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Respectfully submitted,

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